

Attachment Staff-UES 1-12



Operations Bulletin

#OP6.00

SUBJECT: Distribution Inspections

EFFECTIVE: 10/01/01

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1.0 PURPOSE

- To provide a uniform method for maintaining and inspecting overhead and underground distribution systems
- To ensure compliance with applicable regulatory requirements
- To ensure the integrity of the poles and equipment
- To ensure the safe operation of the distribution system
- To establish requirements for record keeping and performance measures

2.0 SCOPE

These maintenance guidelines apply to the electric distribution systems and provide the framework for a structured inspection and reporting process. In addition, it is the responsibility of all employees, in the everyday course of their work, to promptly report any abnormalities of the electric distribution system which may compromise public safety or the integrity of the system.

3.0 MAINTENANCE – FREQUENCY AND CATEGORY SUMMARY

Semi-Annual Inspection

- ♦ Underground Network or Primary Distribution System – a visual inspection to be performed twice annually.

Five-Year Public Safety Inspection

- ♦ Underground Distribution Facilities – A visual safety inspection of underground equipment to be performed every five years.

Ten-Year Public Safety Inspection

- ♦ Overhead Distribution – A visual safety inspection of overhead distribution systems to be performed every ten years.

Ten-Year Pole Test - Distribution pole test to be performed every ten years.

4.0 FREQUENCY AND CATEGORY DESCRIPTIONS

4.10 Semi- Annual Inspection (Manhole System)

A visual inspection of all exposed components located in a manhole and/or vault shall be made at least twice a calendar year. In conjunction with the visual inspection a comparative temperature check will be performed on all connections.

- ♦ The visual inspection shall consist of an examination of the condition of the electrical system, equipment, tagging, and the interior of the structure.
- ♦ Annually, preferably during circuit peak periods, a comparative heat check between phases will be performed on all connections. Heat checks may be conducted more often depending upon the load characteristic of the circuit.
- ♦ Manholes and/or vaults may be checked more often for water problems depending upon rainfall or melting snow.

4.20 Five-Year Public Safety Inspection (Underground Distribution Facilities)

A public safety inspection of company owned underground equipment shall be performed on a five-year cycle because of the proximity and accessibility to the public. A visual observation of above-grade equipment shall identify any potential public safety concerns, as well as conditions affecting service and reliability.

- ♦ Signage

Warning signs/decals shall be in place on all fences, above-grade secondary splice boxes and pad mounted equipment including transformers, sectionalizers and switching cabinets.

- ♦ Security

Padlocks, one time locks and penta head locking bolts, where provided for shall be installed and used on all secondary splice boxes and pad-mounted equipment.

- ◆ Condition

The condition of the pad, pad-mounted equipment and secondary splice boxes shall be observed with particular attention paid to location of the equipment on the pad, the grade level surrounding the pad, and the general physical condition of the unit.

Specific attention shall be noted to the following items:

- ◆ Properly alignment on pad.
- ◆ No holes
- ◆ Free of rust
- ◆ No visible oil leaks
- ◆ No excessive gap or spaces in cabinet doors.
- ◆ Proper clearance from buildings, roads, fences.
- ◆ Traffic barriers in place if required.
- ◆ Proper vegetation clearance.

4.30 Ten-Year Public Safety Inspection (Overhead Distribution Facilities)

Overhead distribution facilities shall be visually inspected every ten-years to identify potential failure, deterioration of construction, unsafe conditions or possible public safety hazards.

Specific attention shall be noted to the following Items:

- ◆ Wires' passing through trees to the extent that someone working in, or climbing the tree, might be unaware of the presence of the wires.
- ◆ Low or overhanging wires, in areas that could contact or be contacted by buildings, ladders, vehicles, etc.
- ◆ Damaged or deteriorated equipment such as cross-arms, insulators, terminators, etc.
- ◆ Climbing steps or standoff brackets on poles located lower than eight (8) feet above grade or the nearest surface from which climbing would commence.
- ◆ Construction activity, which might encroach on areas, occupied by company facilities or changes in the use of land, roads, or buildings.
- ◆ Massachusetts Department of Public Works requires that utility poles adjacent to state maintained highways, which are located within six (6) feet of the edge of a traveled way, and not protected by guardrails will have reflective markers mounted on or attached to the pole. The reflector will be located on the pole in such a manner that they are visible to on-coming traffic.
- ◆ Foreign attachment to Company equipment that would cause potential danger to the public or Company personnel.

4.40 Ten-Year Pole Test

On a ten-year cycle, wood distribution poles in the DOC's maintenance area shall be visually inspected and tested at and below grade level to determine the soundness of the wood.

Wood Pole Maintenance Procedures

The purpose of this section is to identify destructive forces that affect wood poles. The following outlines a replacement program based on periodic tests to confirm the presence and determine the degree of the decay.

Destructive Forces

One of the most destructive forces affecting wooden poles is decay. It will generally progress at a predictable rate and its advance can be readily diagnosed in the field at all but the very early stages. Detection of decay or damage is essential in establishing the remaining pole life.

Types of Decay

Internal Decay

Internal deterioration of treated poles is due very largely to development of checks after treatment that exposes the untreated center portion of the pole to fungi and insects.

External Decay

External Decay results from using poor preservative or from a low absorption of the preservative by the timber. In older poles, external decay is a consequence of gradual loss of most of the preservative in the sapwood through leaching, evaporation, and chemical change. In butt-treated cedar poles, a softening of the sapwood known as "shell rot" occurs in the upper untreated portion of the pole. Such decay starts in the inner sapwood where air and moisture conditions promote fungus growth, and eventually extends to the outer sapwood.

Groundline Decay

In most cases, the first occurrence of decay will be just below the groundline. This is where the conditions of moisture, temperature, air, and the absence of direct sunlight are most favorable to the growth of fungi. This is a portion of the pole usually hidden from view and it is close to the natural breaking point of a pole under strain. This is the most

critical part of the pole and warrants special inspection.

Detection of Decay

Two methods are generally used to determine the presence and the degree of decay in poles. Sounding a pole with a hammer, mechanical sounding tool, or electronic sonic pole tester will usually detect the presence of decay. Boring the suspect pole with a brace and bit or an increment borer will confirm the presence and determine the degree of the decay.

Determining the Serviceability of Decayed Poles

The decision to replace a decayed pole shall depend upon the remaining strength of the pole. The permissible reduced circumference of a pole is a good measure of serviceability.

Pole Circumference Safety Factors

Wood pole lines are designed using pole strength safety factors. For this bulletin, the groundline circumference of the pole will be used as a measure of pole strength. Table 1 shows the relationship between new pole circumferences, and reduced circumferences. Circumference reductions to compensate for other categories of decay, as shown in table 2, 3, and 4 should be applied to the circumferences in table 1 to determine the resultant reduced circumference.

If the reduced circumference is less than, or equal to the replacement circumference, the pole should be replaced.

5.0 RECORD KEEPING

The results of all cycle inspections and tests and corrective action taken shall be recorded, and retained for one complete cycle but not less than a period of six (6) years. Appropriate measures shall be taken on a timely schedule to correct any defects and/or deficiencies found on test or inspections. Inspection forms shall identify all poles/transformers visited. All non compliant findings shall be noted indicating corrective action to be taken and close out date (i.e., when corrective action was completed)

5.10 Forms

Forms to be used for inspection and record keeping purposes are included as Attachments A, B, and C.

6.1 PERFORMANCE MEASURES

6.10 Overview

Performance measures are intended to provide the means to monitor performance with respect to this guideline. The performance measures fall under three general categories, Plan and Progress Reporting, Effectiveness Metrics, and Efficiency Metrics.

Each DOC shall report the performance measures monthly. A quarterly Unitil System Summary shall consist of a consolidation of all three DOCs.

The following accounts shall be utilized for budgeting and tracking related cost and provides the data source for the Efficiency Metrics.

583.05	Overhead Dist. – Non-Maint. Area	OH Inspection cost - Unitil
583.06	Overhead Dist. – Maint. Area	OH Inspection costs – non-Unitil maint.
584.04	Underground Equip. Inspections	Underground Inspection costs

6.20 Plan and Progress Reporting

By January 1 of each year each DOC shall specify planned cycle inspection and pole testing work for the year. For each inspection category, the "Number in Service" shall also be updated as required.

Each month the actual work completed for each cycle inspection shall be reported and an indication of work schedule accuracy shall be calculated.

The following inspection categories shall be reported:

Manhole System Inspections
Underground Distribution Device Inspection
Overhead Distribution Inspection + Pole Test
(for Unitil maintenance area)
Overhead Distribution Inspection
(for non-Unitil maintenance area)

6.30 Effectiveness Metrics

One effectiveness metric for distribution inspections shall be reported – the **Pole Test Reject Rate**. This metric is tied to Pole Testing (Unitil maintenance area) and requires the number of poles rejected per test be reported monthly.

6.40 Efficiency Metrics

The efficiency metrics for distribution inspections shall be as follows
(requires monthly reporting of costs):

Underground Device Inspection - Cost per Device

Pole Inspection + Test – Cost per Pole
(Unitil maintenance area)

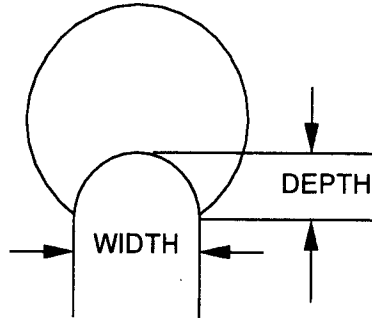
Pole Inspection – Cost per Pole
(Non-Unitil maintenance area)

Table 1 – Pole Testing Table
Replacement based on remaining circumference at ground line

08/09/01

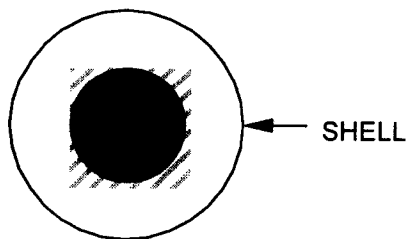
Pole Circumference (Installed)	Douglas Fir & Southern Yellow Pine		Western Red Cedar	
	Transmission	Distribution	Transmission	Distribution
30	21.4	23.8	19.5	21.6
31	22.2	24.6	20.1	22.4
32	22.9	25.4	20.8	23.1
33	23.6	26.2	21.4	23.8
34	24.3	27.0	22.1	24.5
35	25.0	27.8	22.7	25.2
36	25.7	28.6	23.4	26.0
37	26.4	29.4	24.0	26.7
38	27.2	30.2	24.7	27.4
39	27.9	31.0	25.3	28.1
40	28.6	31.7	26.0	28.8
41	29.3	32.5	26.6	29.6
42	30.0	33.3	27.3	30.3
43	30.7	34.1	27.9	31.0
44	31.4	34.9	28.6	31.7
45	32.2	35.7	29.2	32.5
46	32.9	36.5	29.9	33.2
47	33.6	37.3	30.5	33.9
48	34.3	38.1	31.2	34.6
49	35.0	38.9	31.8	35.3
50	35.7	39.7	32.5	36.1
51	36.4	40.5	33.1	36.8
52	37.2	41.3	33.8	37.5
53	37.9	42.1	34.4	38.2
54	38.6	42.9	35.1	38.9
55	39.3	43.7	35.7	39.7
56	40.0	44.4	36.4	40.4
57	40.7	45.2	37.0	41.1
58	41.4	46.0	37.7	41.8
59	42.2	46.8	38.3	42.5
60	42.9	47.6	39.0	43.3
61	43.6	48.4	39.6	44.0
62	44.3	49.2	40.3	44.7
63	45.0	50.0	40.9	45.4
64	45.7	50.8	41.6	46.2
65	46.5	51.6	42.2	46.9
66	47.2	52.4	42.9	47.6
67	47.9	53.2	43.5	48.3
68	48.6	54.0	44.2	49.0
69	49.3	54.8	44.8	49.8

Table 2
Reduction in measured circumference of pole to compensate
for external pocket



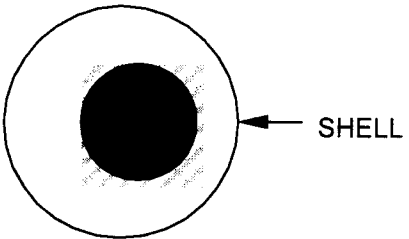
Width of pocket (inches)	1					2					3					4					5					6				
Depth of pocket (Inches)	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Measured circumference Of pole (inches)	Reduction in circumference (inches)																													
30 to 40	1	1	1	2	2	1	2	2	3	3	2	3	4	4	4	2	4	5	5	6	3	5	6	7	8	5	7	8	9	10
40 to 50	1	1	1	2	2	1	2	2	3	3	2	3	3	4	4	2	3	4	5	6	3	4	5	6	7	3	5	6	7	8
50 to 60	1	1	1	2	2	1	2	2	3	3	2	3	3	4	4	2	3	3	4	5	3	4	4	5	6	3	4	5	6	7

Table 3
Reduction in measured circumference of pole to compensate
for hollow heart



Width of pocket (inches)	3	3 1/2	4	4 1/2
Measured circumference of pole (inches)	Reduction in circumference (inches)			
30 to 40	2	1	0	0
40 to 50	3	2	1	0
50 to 60	4	3	2	1

Table 4
Reduction in measured circumference of pole to compensate
For enclosed pocket



Diameter of pocket (inches)	3			4			5		
Minimum thickness of shell (inches)	1	2	3	1	2	3	1	2	3
Measured circumference of pole (inches)	Reduction in circumference (inches)								
30 to 40	2	1	1	3	1	1	4	2	1
40 to 50	2	1	1	3	2	1	4	3	1
50 to 60	2	2	1	3	3	1	4	3	1

UNITIL MANHOLE / VAULT REPORT

MANHOLE/VAULT CHECKLIST				
Manhole/Vault #		Account #		Date:
		Value	N/A	Yes No
1	Oxygen Level (Acceptable range: 19.5 to 25%)			
2	Gas Level (Presence of gas requires ventilation)			
3	Manhole Dry			
4	Sump Pump Working			
5	Vault Lights Working			
6	Vault Outlets Working			
7	Primary Connections Okay			
8	Secondary Connections Okay			
9	Neutrals and Grounds Free of Corrosion			
10	Arcproofing Tape Installed on Primary Cable			
11	Circuit Labels and Tags Okay			
12	Cable Racks Okay			
13	Vac Pac Switches Okay			
14	Manhole Castings, Hatches, etc. Okay			
15	Circuit Protectors	Manual	Auto	Open Closed
	a Operating Handle Position			
	b Protector Position			
	c Protector Okay	Value	Yes	No
	d Fuse Okay			
	e Counter Reading			
16	Transformers			
	a Record Number			
	b Transformer Okay			
	c Current Temperature			
	d Maximum Temperature			
	e Liquid Level - Main Tank			
	f Liquid Level - Primary Switch Comp.			
17	Primary Switch Okay			
			Open	Closed
18	Primary Switch Position			
19	Check Primary Connection Temperatures:			
Location of Temp by Circuit #		Temp	Location of Temp by Circuit # Temp	
A			P	
B			Q	
C			R	
D			S	
E			T	
F			U	
G			V	
H			W	
I			X	
J			Y	
K			Z	
L			AA	
M			AB	
N			AC	
O			AD	
Comments:				

UNITIL OVERHEAD DISTRIBUTION AND POLE TEST REPORT

Ten-Year Public Safety Inspection & Ten-Year Pole Test

A visual safety inspection of overhead distribution facilities to be performed every ten years.

Date:		Inspected By:		Page	of
Legend:	N/A = Not Applicable, ✓ = Checked OK, X = Needs Attention for specific refer to comments / notes				

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